

FIG. 1A
(PRIOR ART)

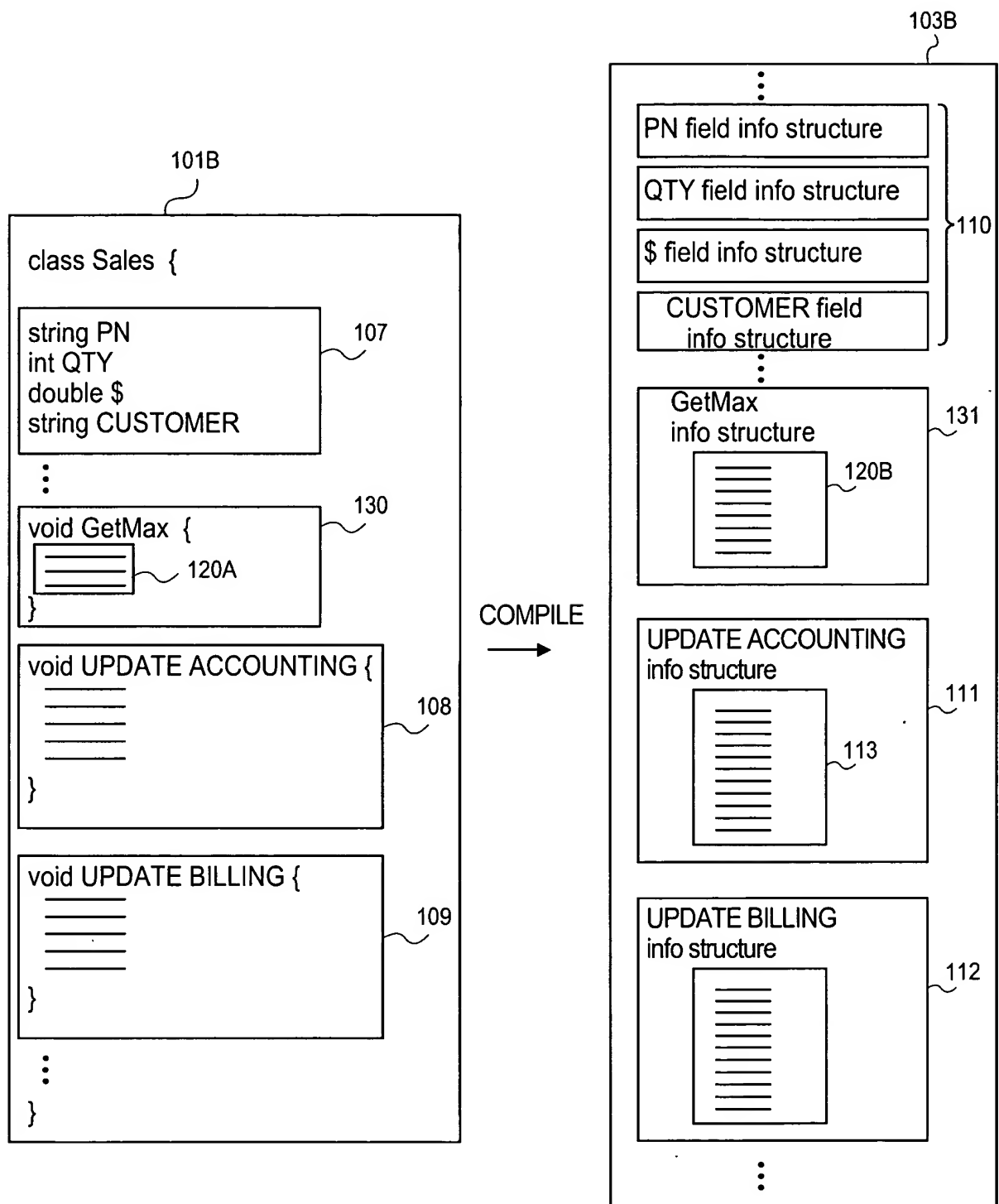


FIG. 1B
(PRIOR ART)

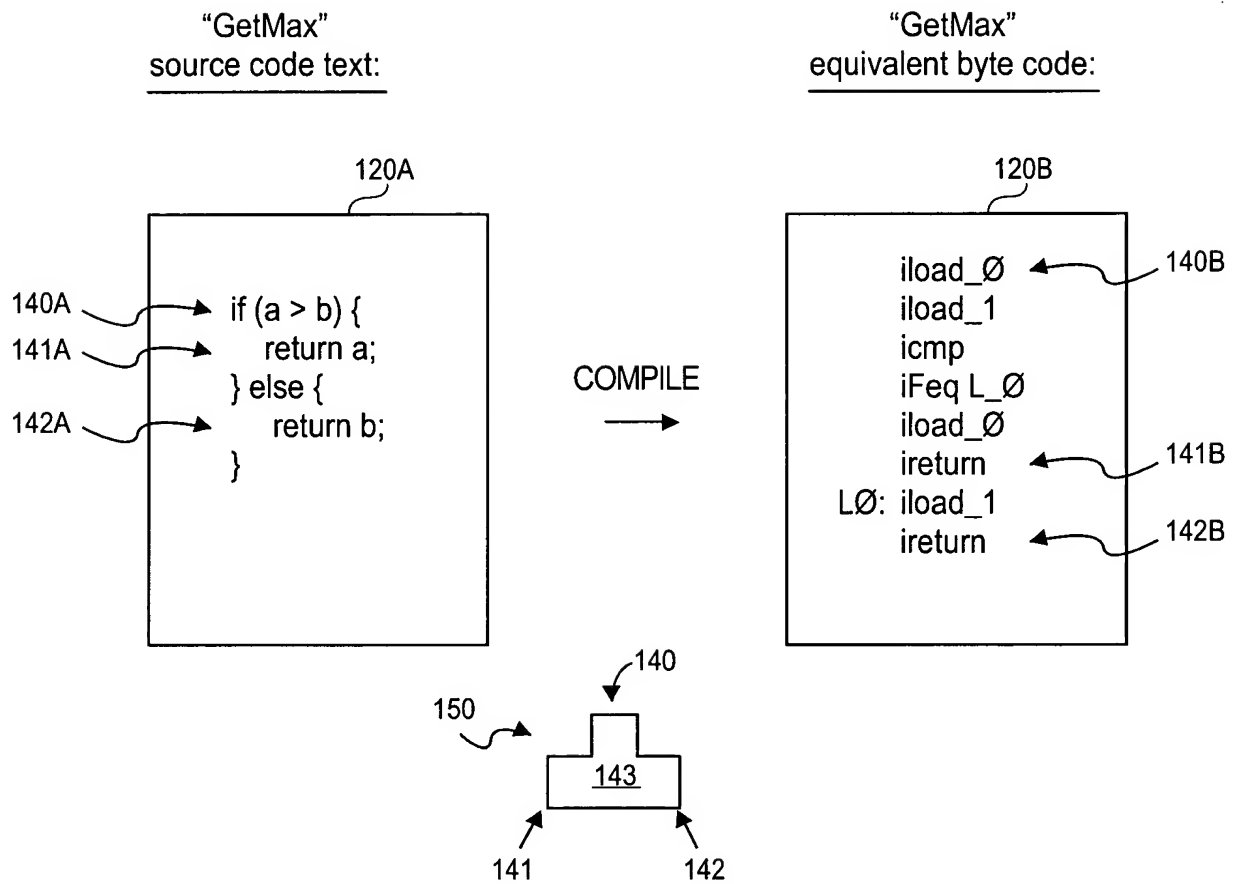


FIG. 1C
(PRIOR ART)

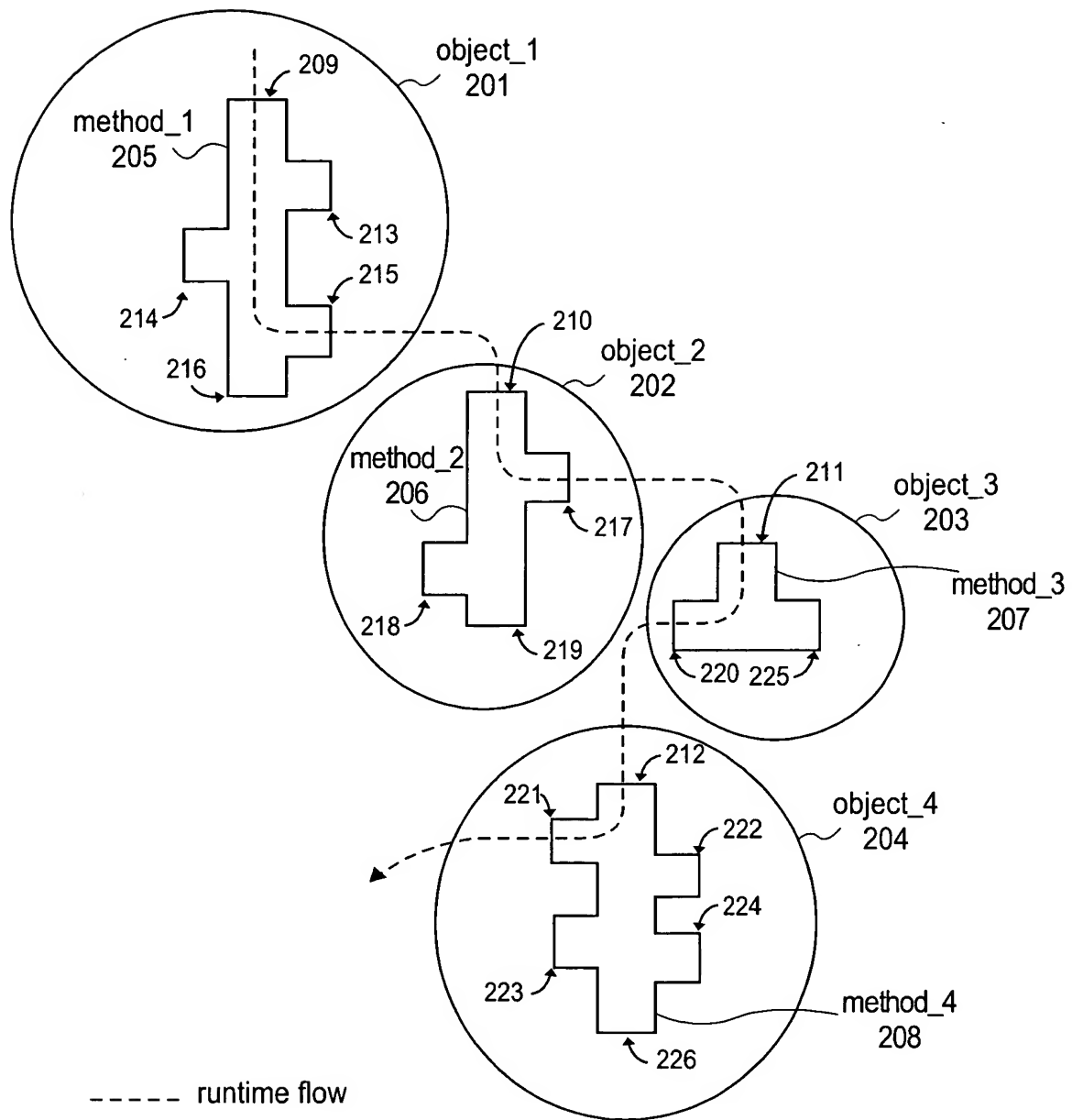


FIG. 1D
(PRIOR ART)

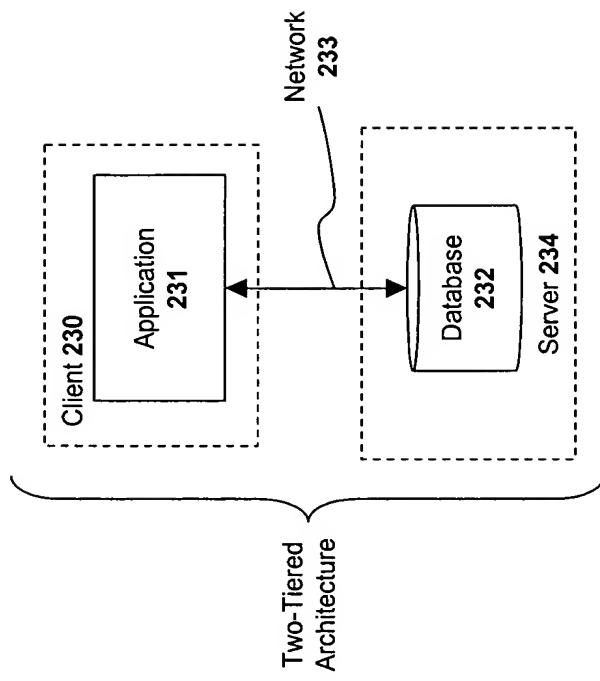


FIG. 2A
(prior art)

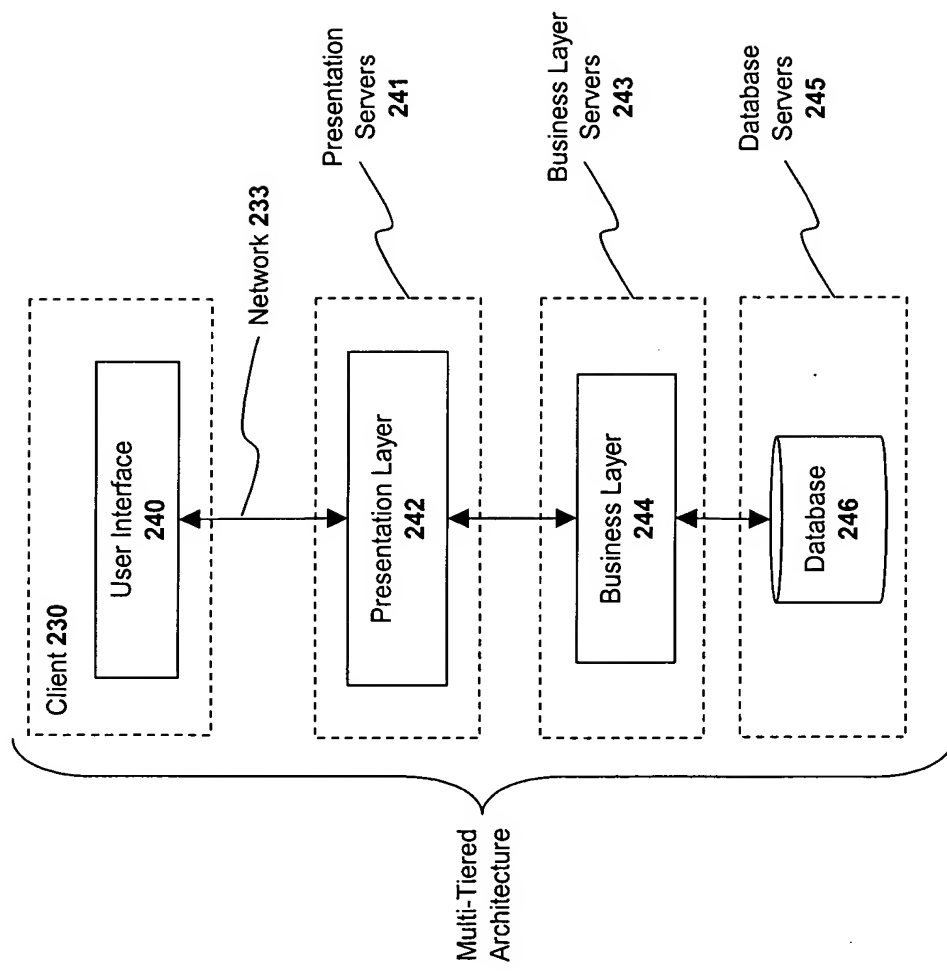


FIG. 2B
(prior art)

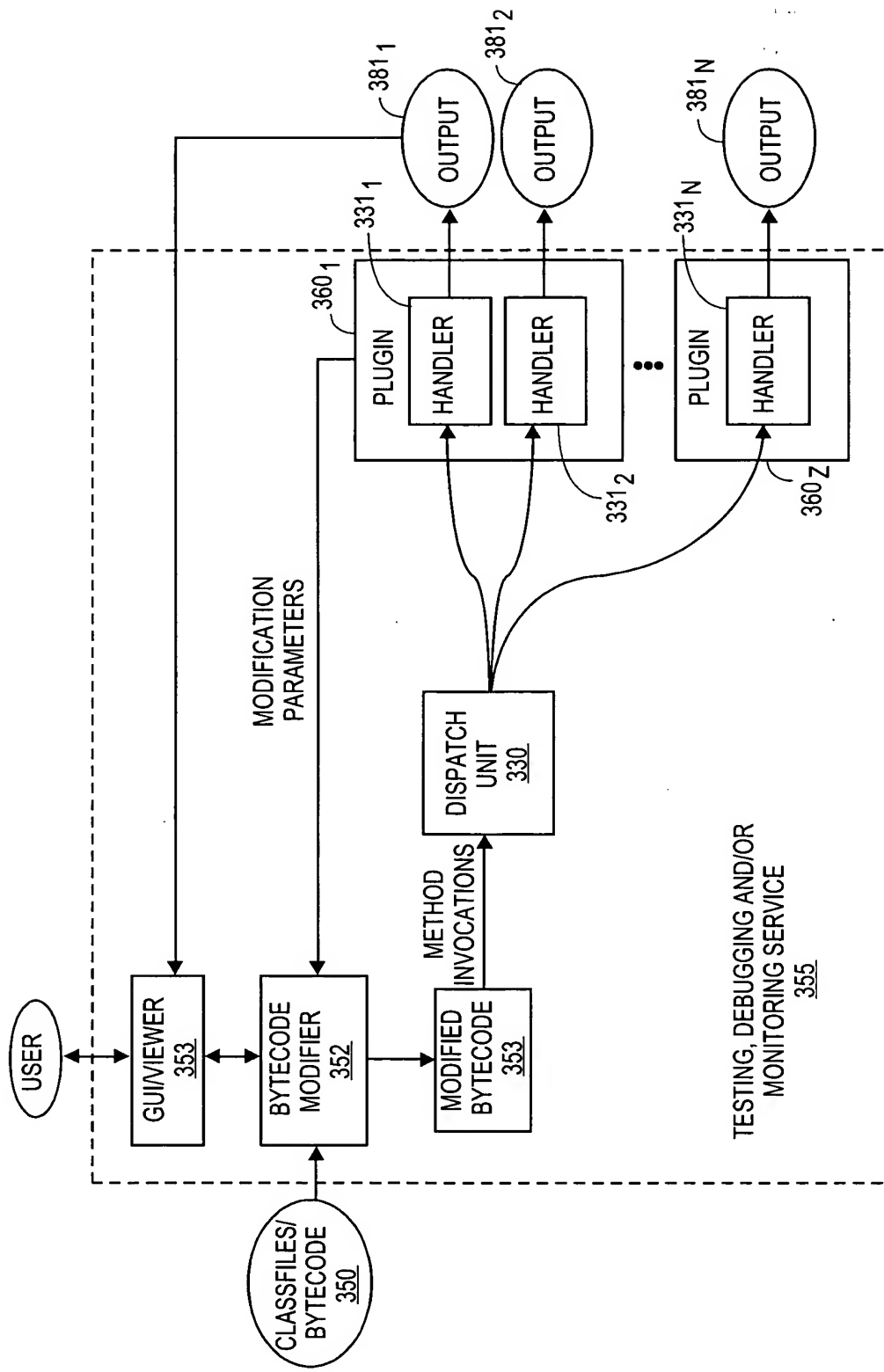


FIG. 3

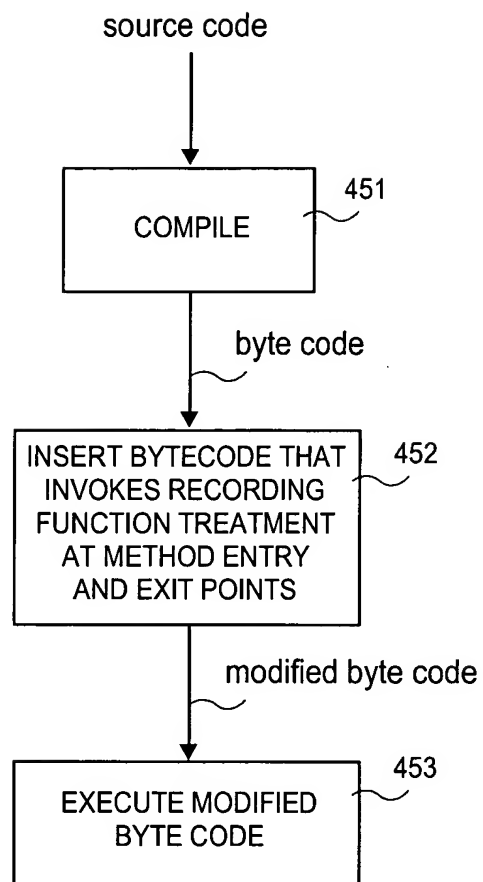


FIG. 4A

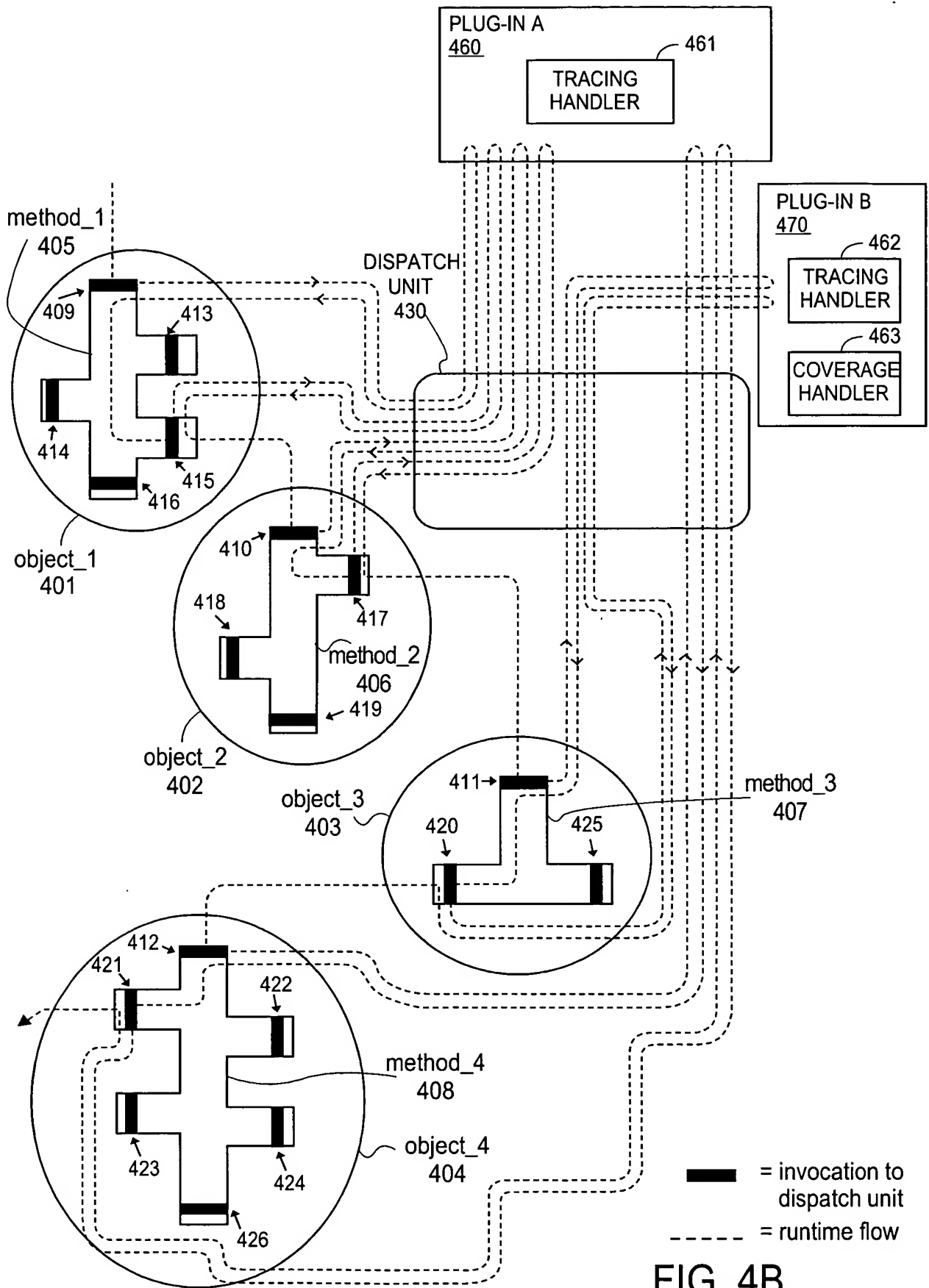


FIG. 4B

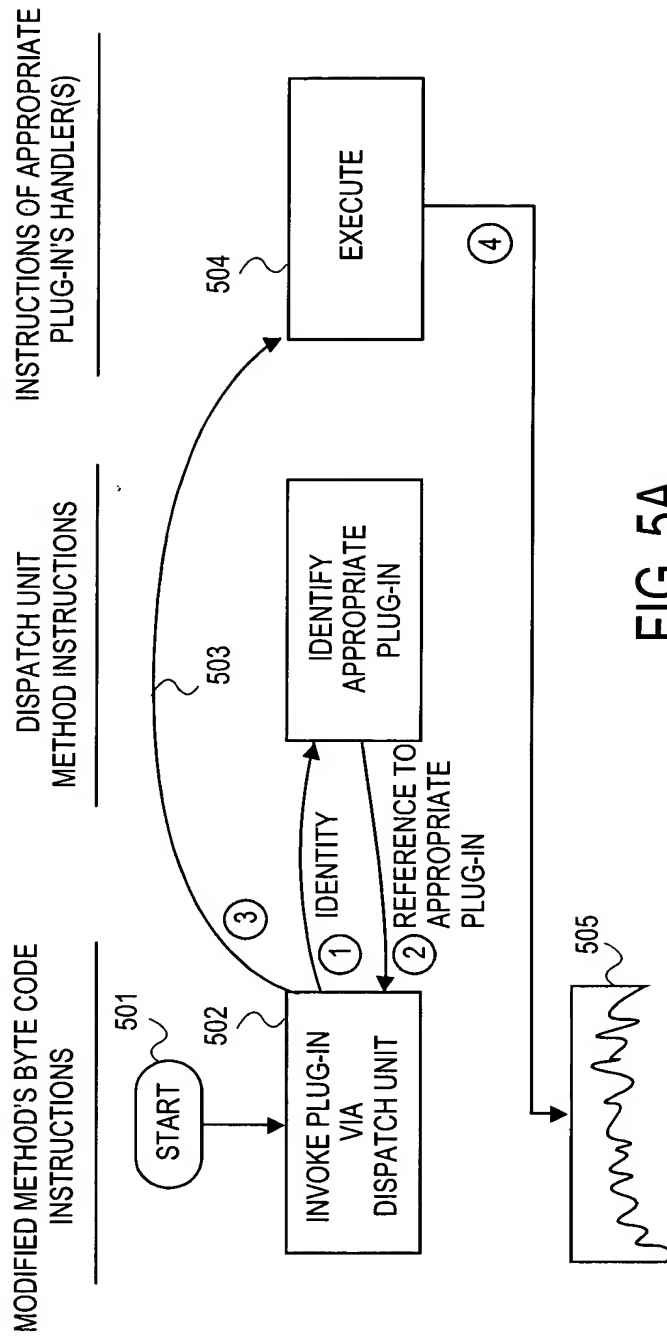


FIG. 5A

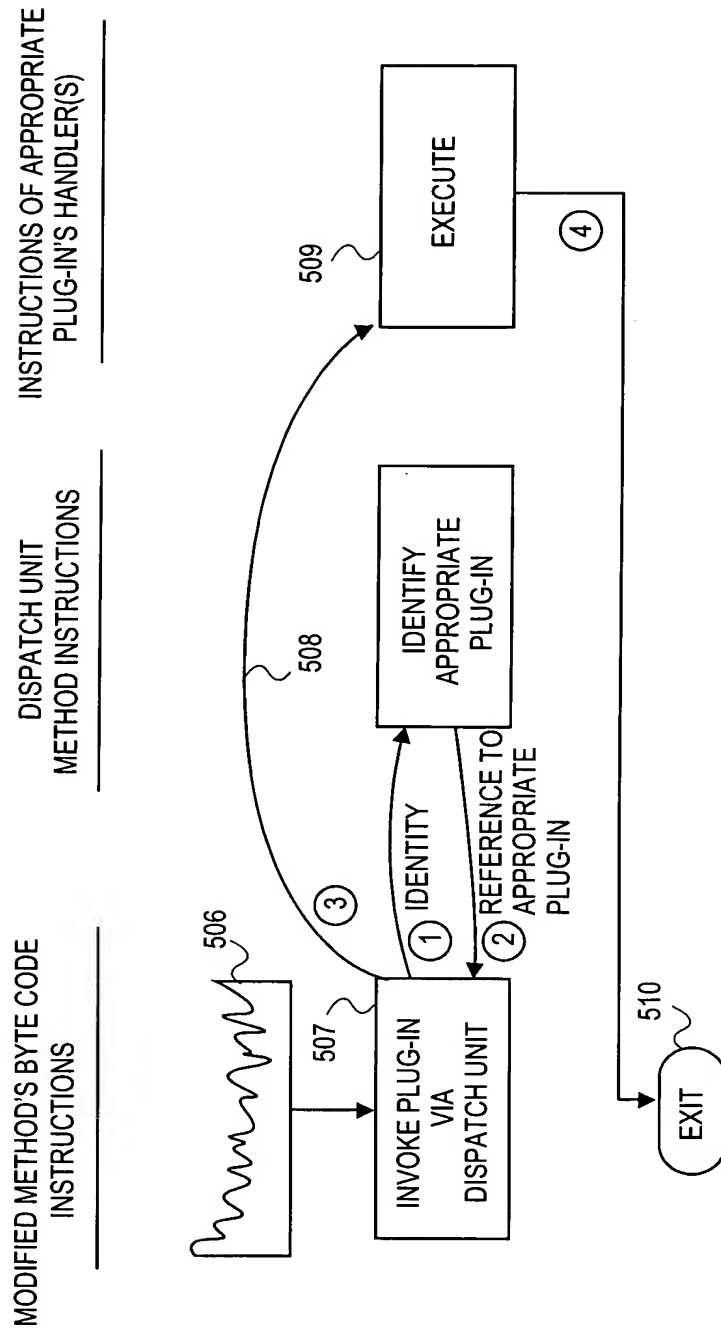


FIG. 5B

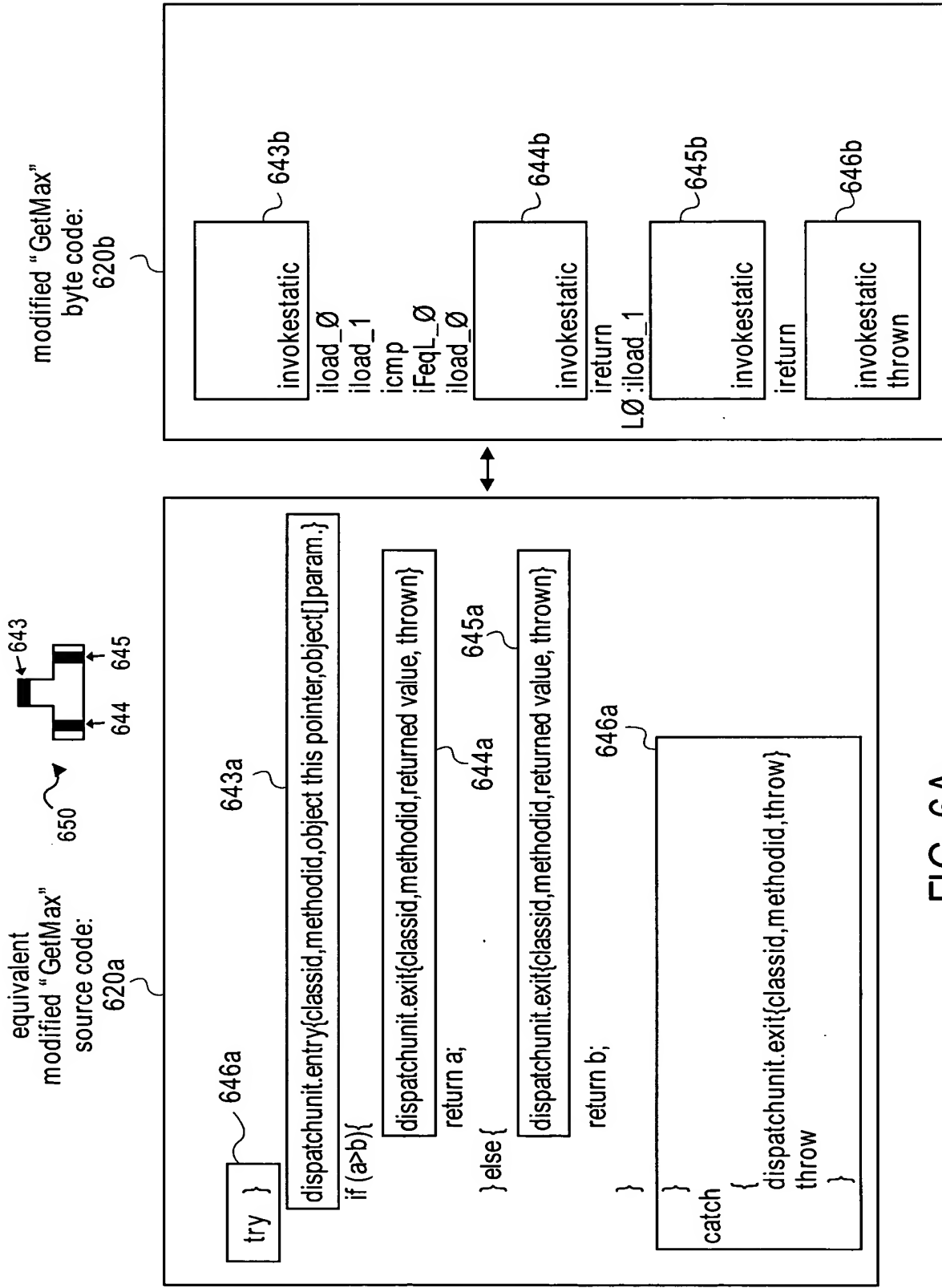


FIG. 6A

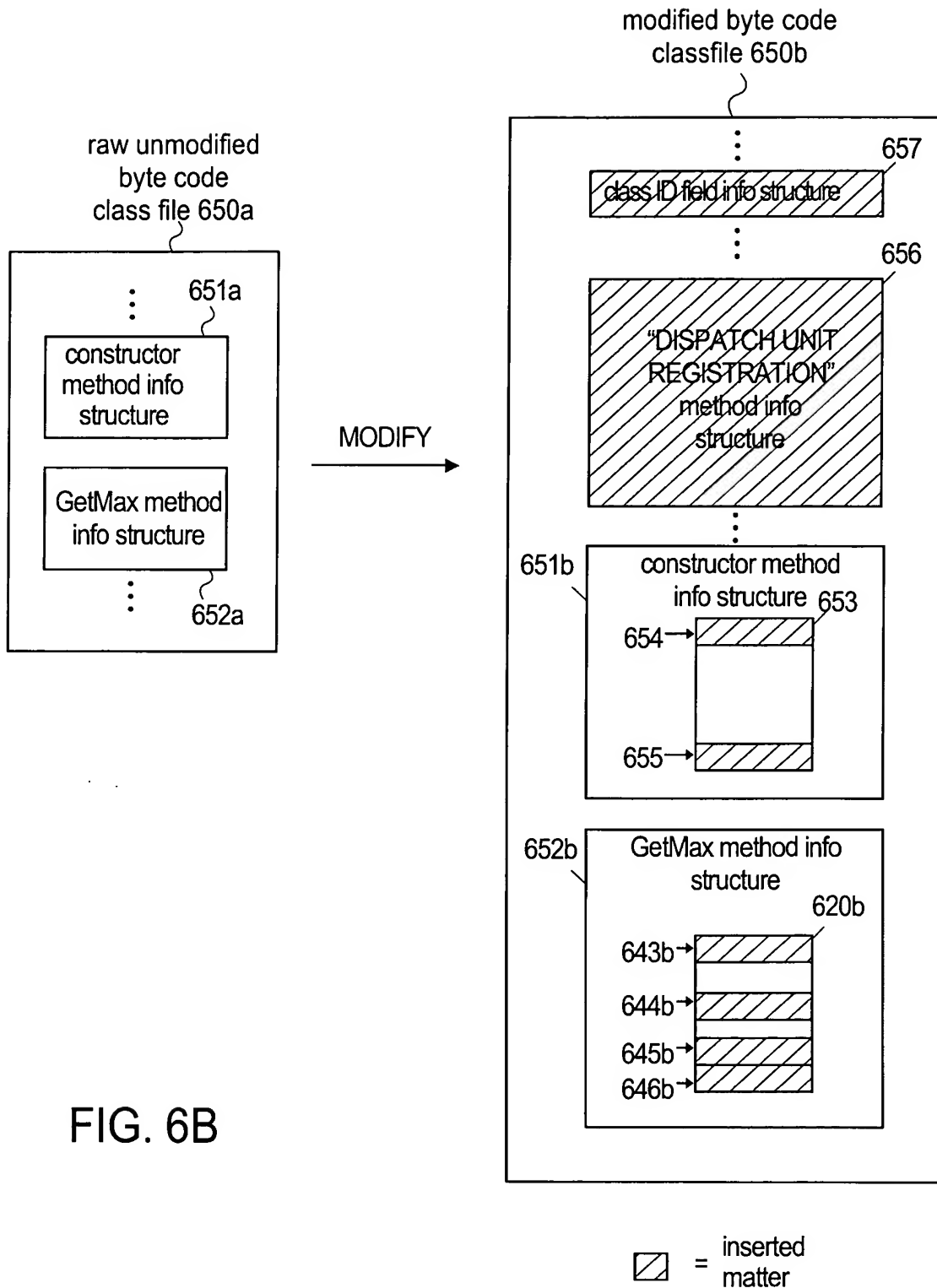


FIG. 6B

701

	INVOKING METHOD	PLUG IN MODULE
(method_1)	C ₁ , M ₁ , args ₁₁	PIM_A
(method_2)	C ₁ , M ₂ , args ₁₂	PIM_A
(method_3)	C ₂ , M ₁ , args ₂₁	PIM_B
(method_4)	C ₃ , M ₁ , args ₃₁	PIM_A

FIG. 7

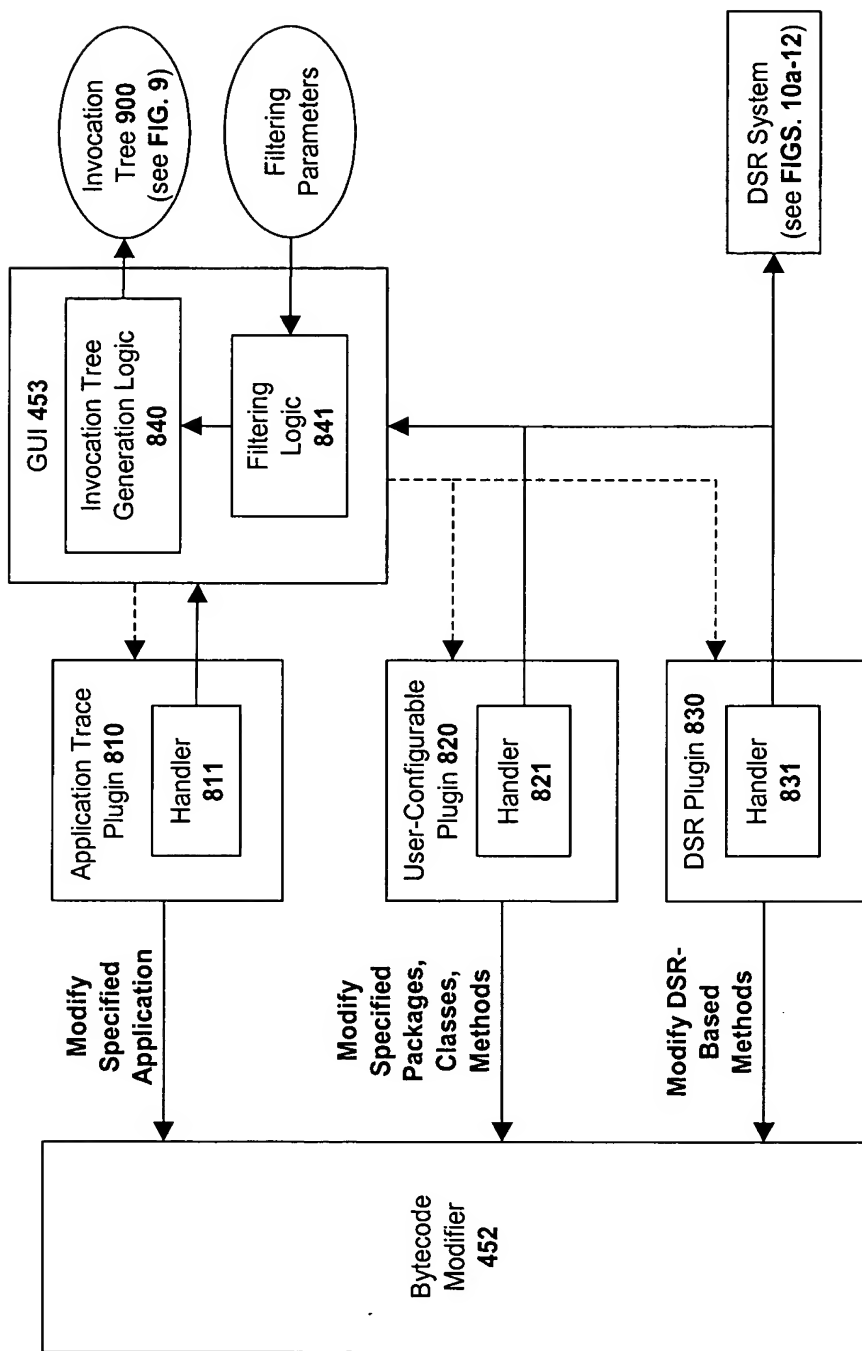


FIG. 8

Invocation Tree

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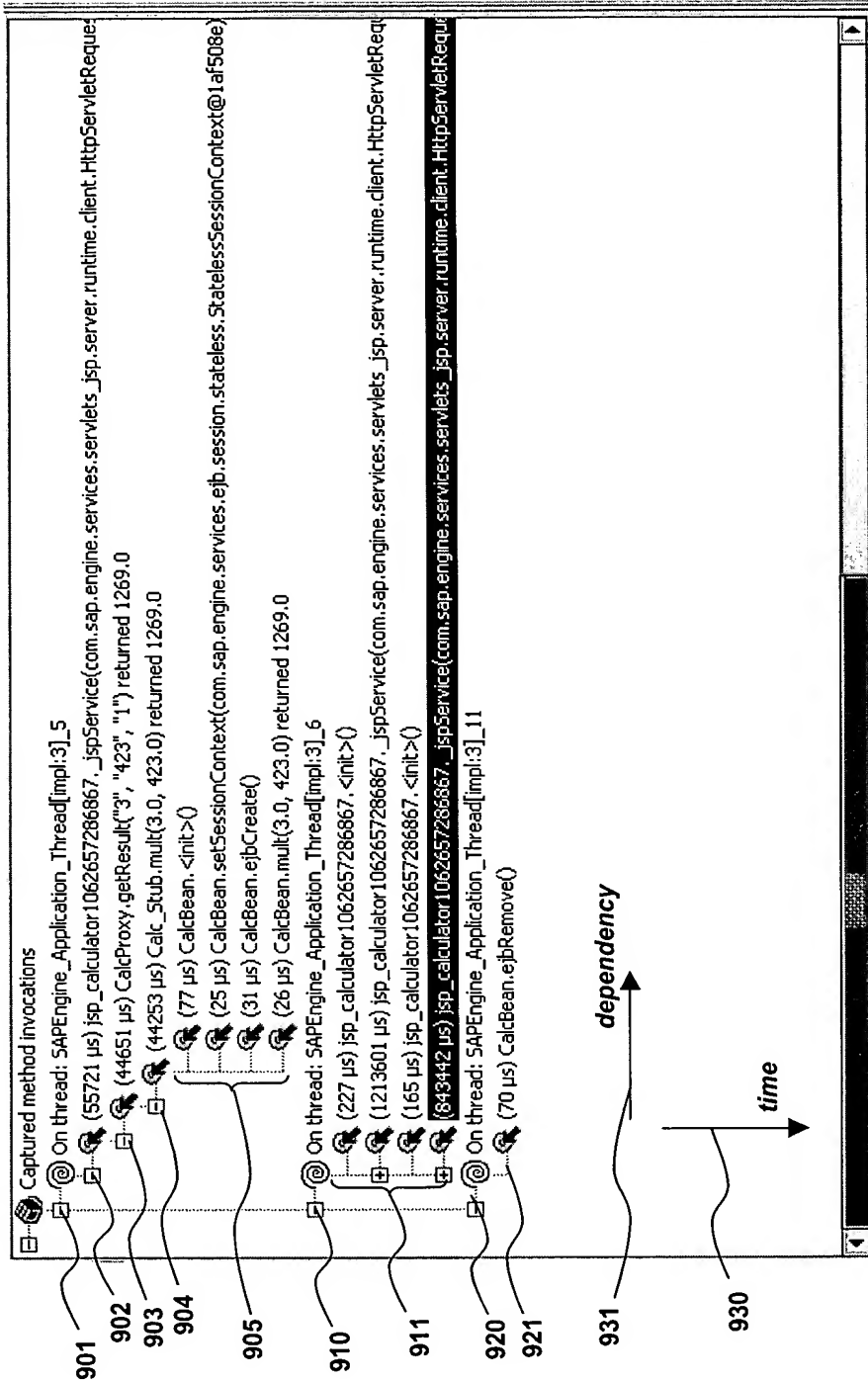


FIG. 9A

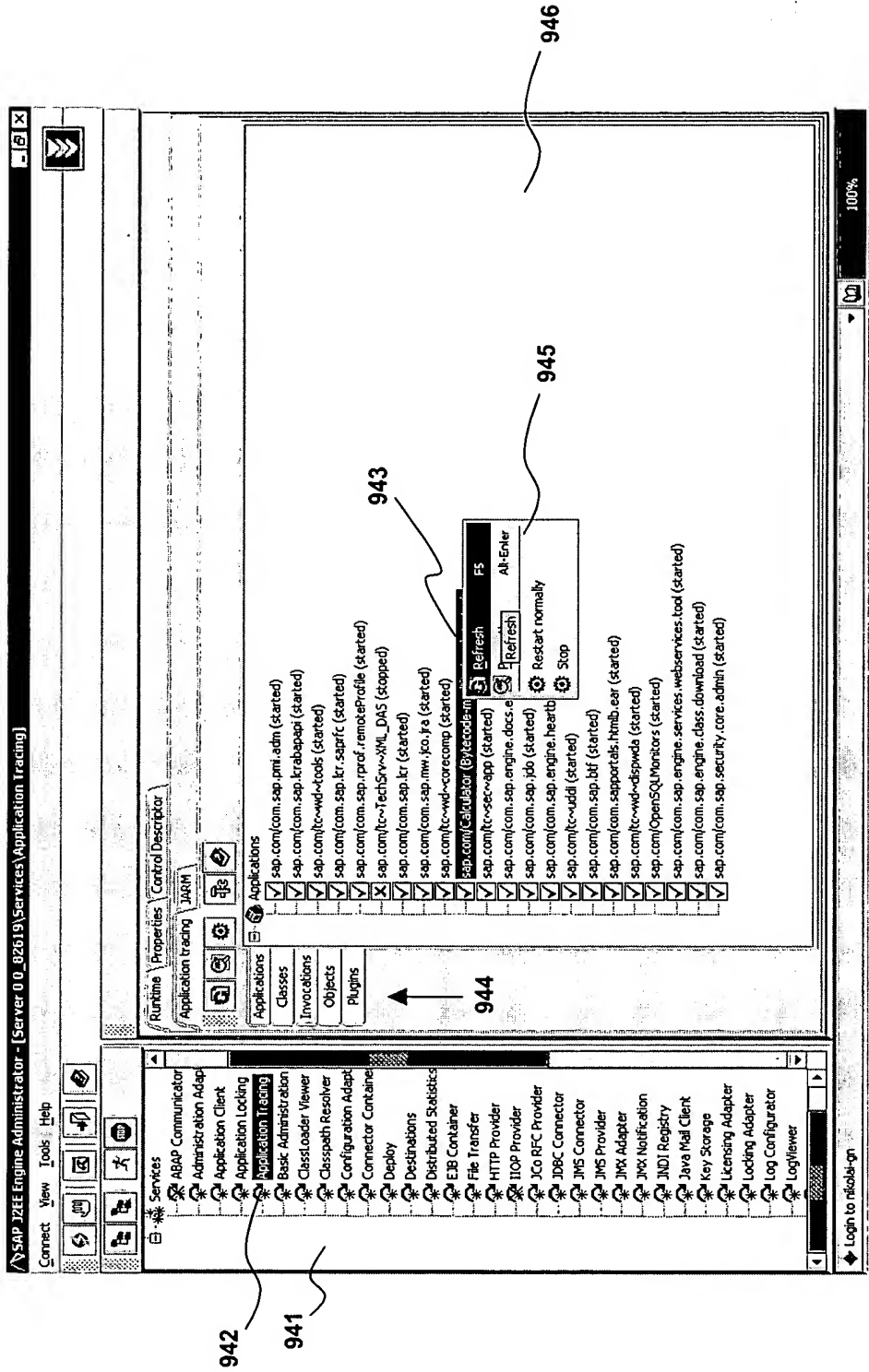


FIG. 9B

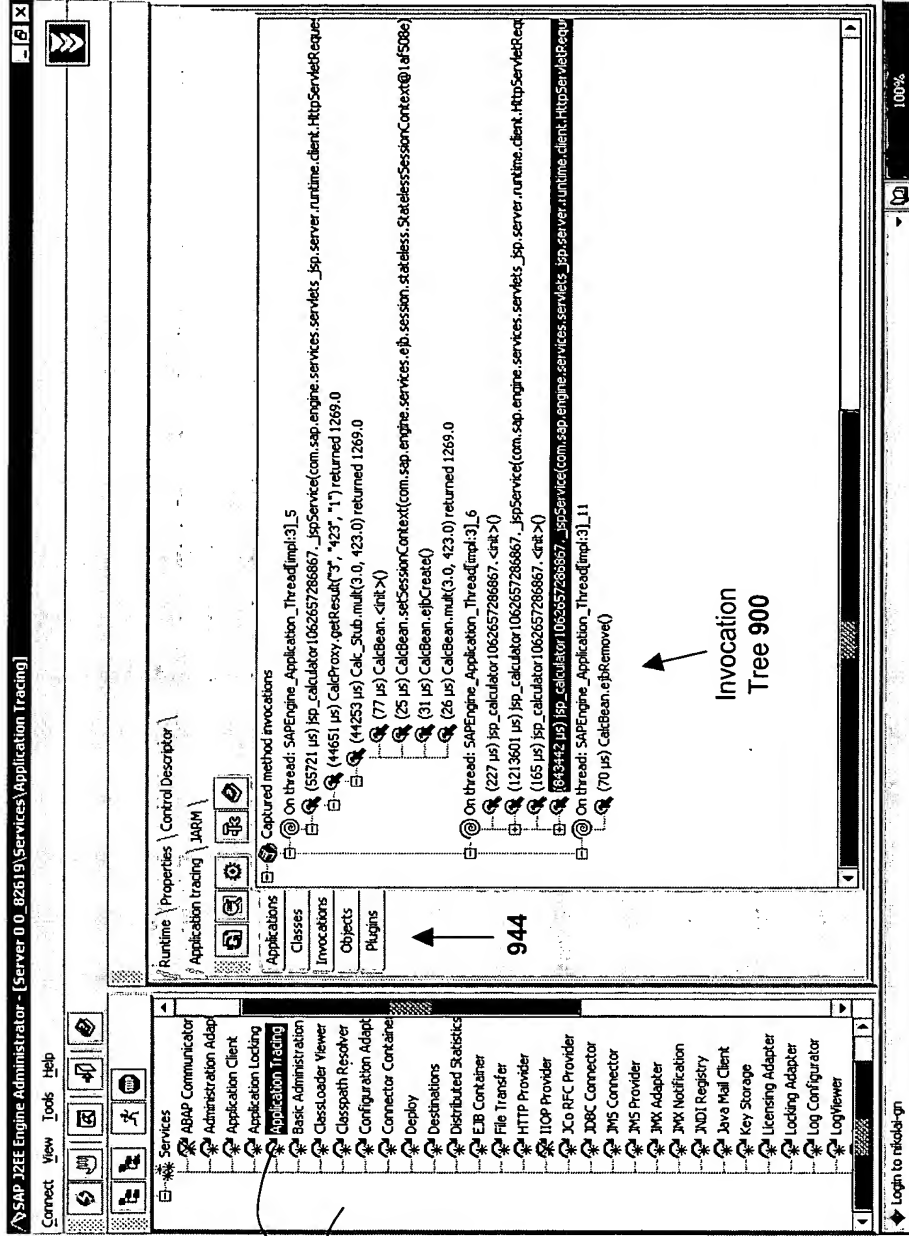
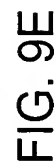


FIG. 9C



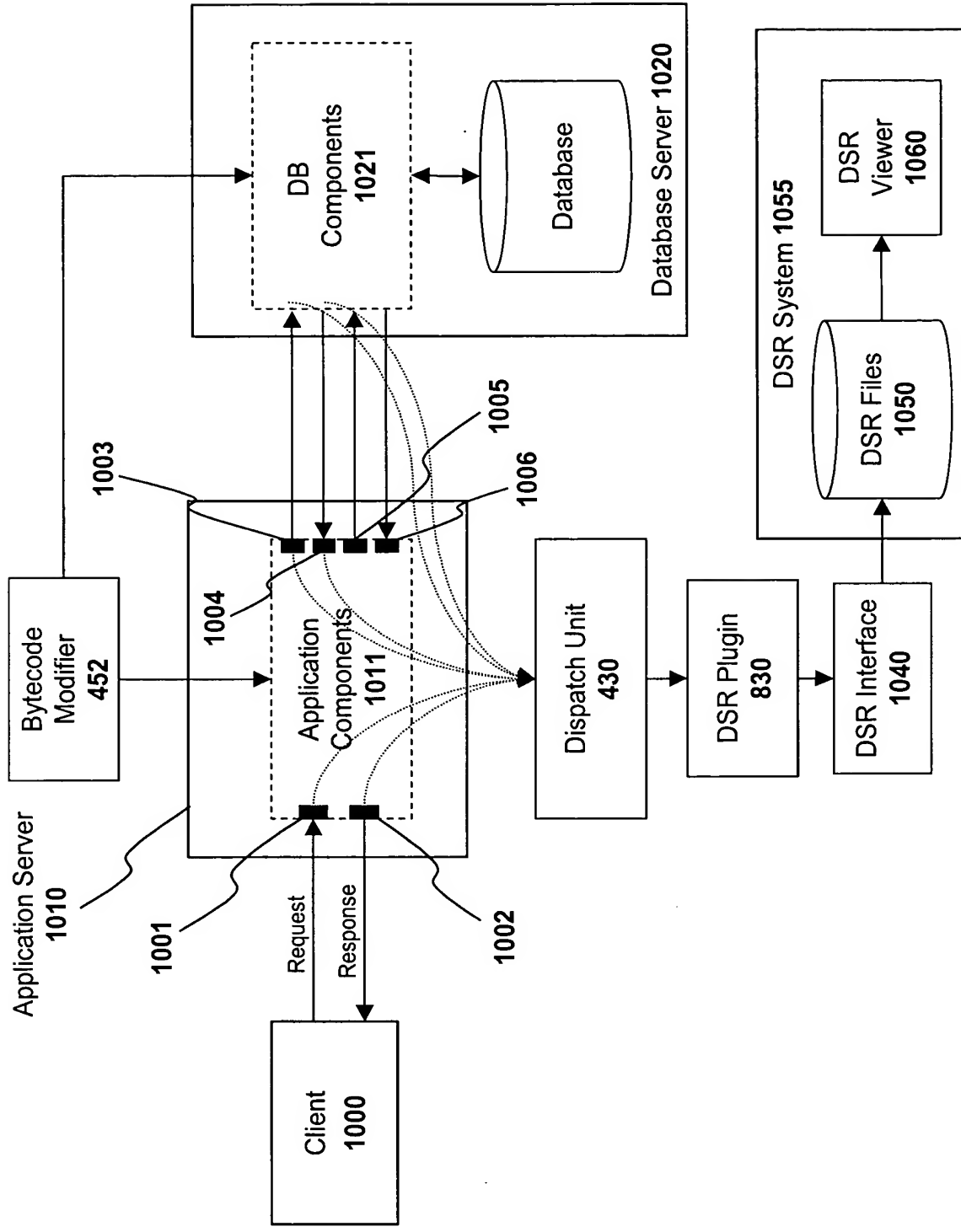


FIG. 10A

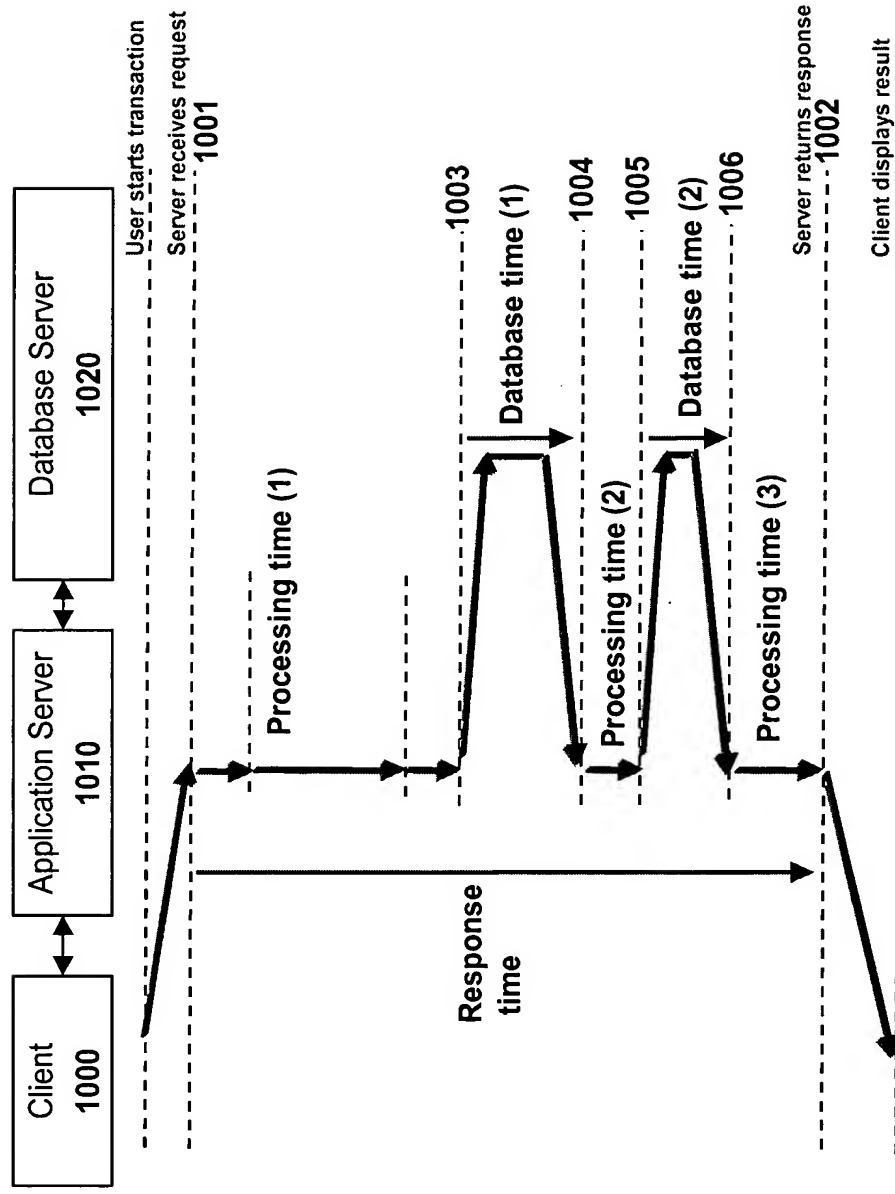


FIG. 10B

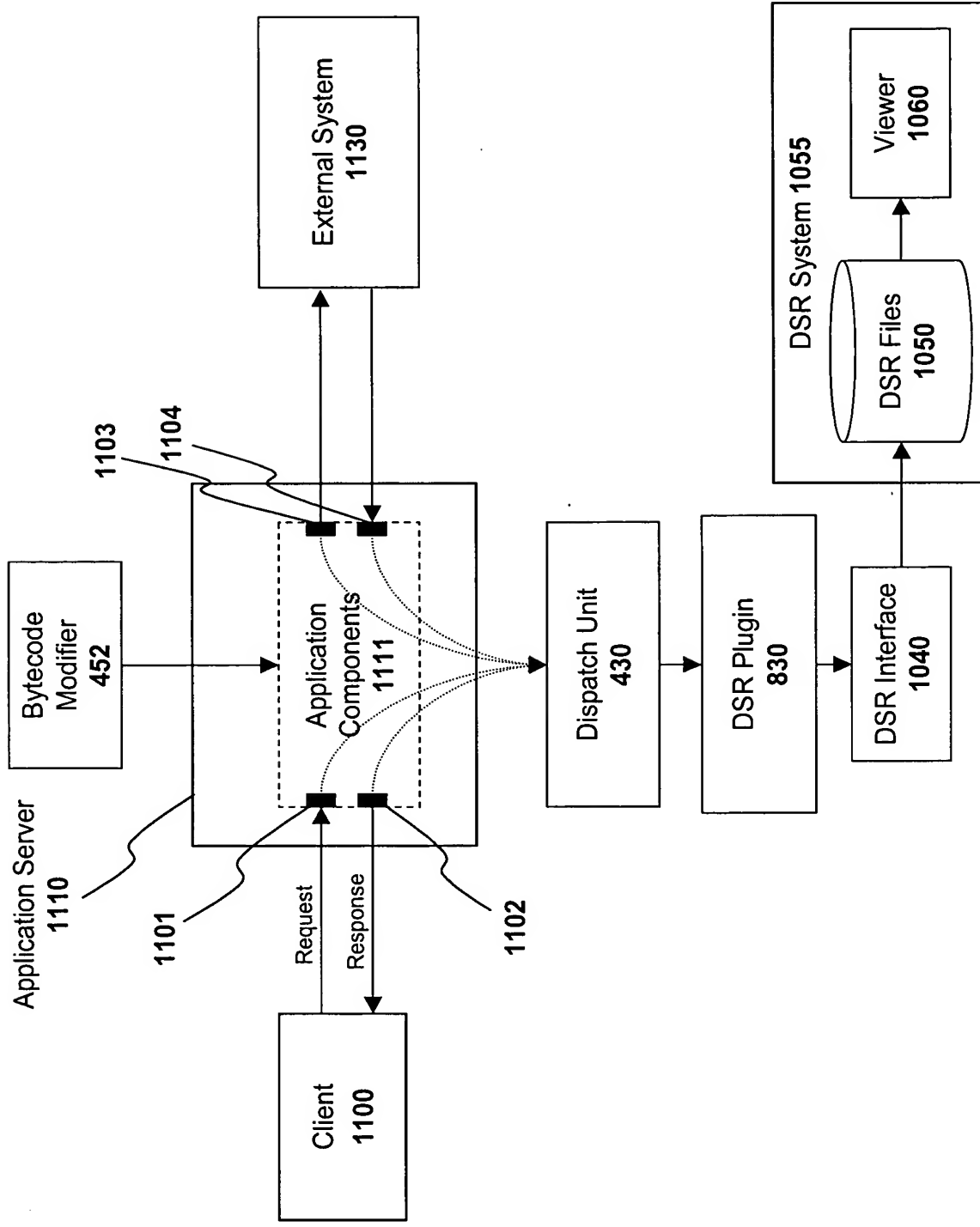


FIG. 11A

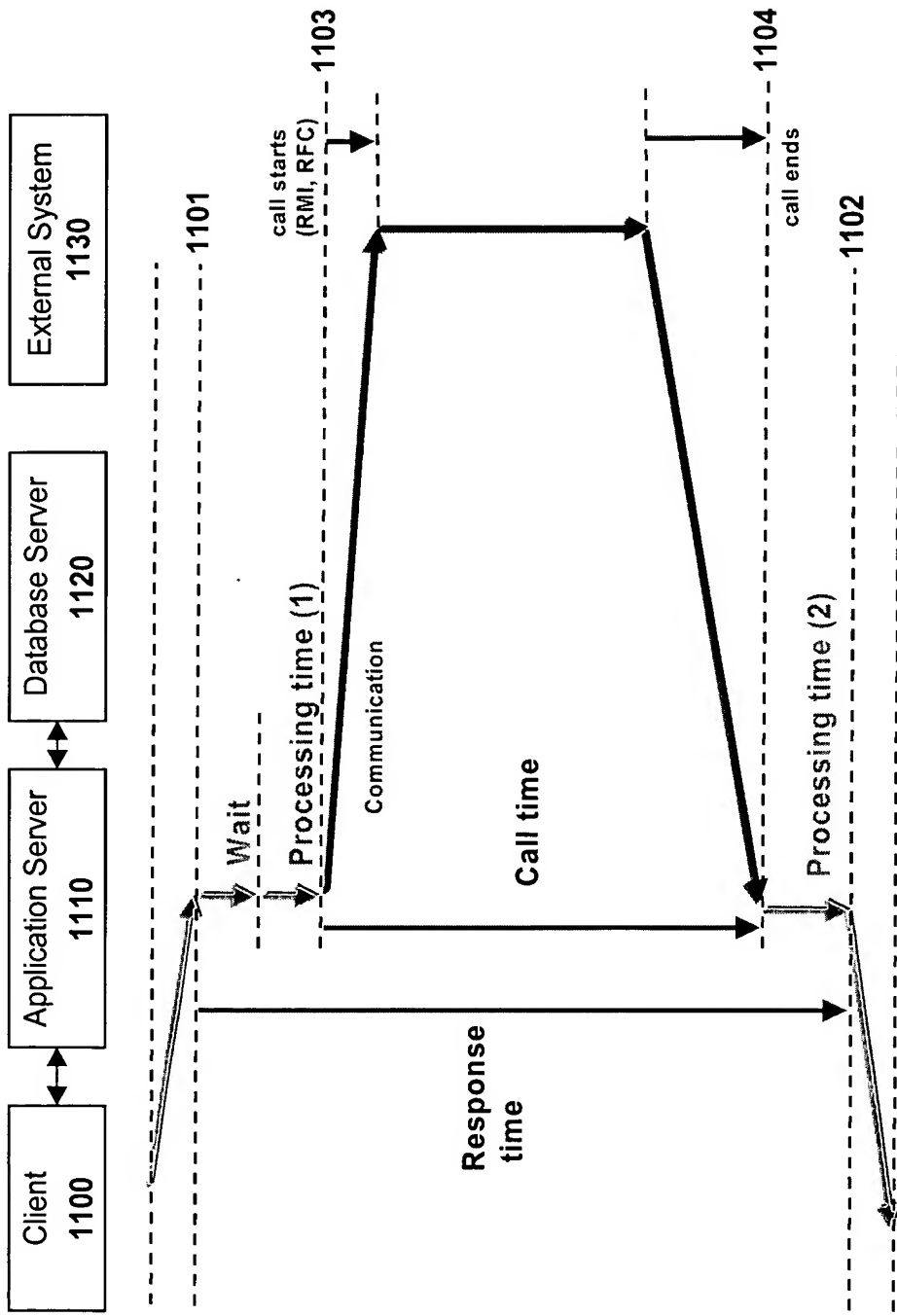


FIG. 11B

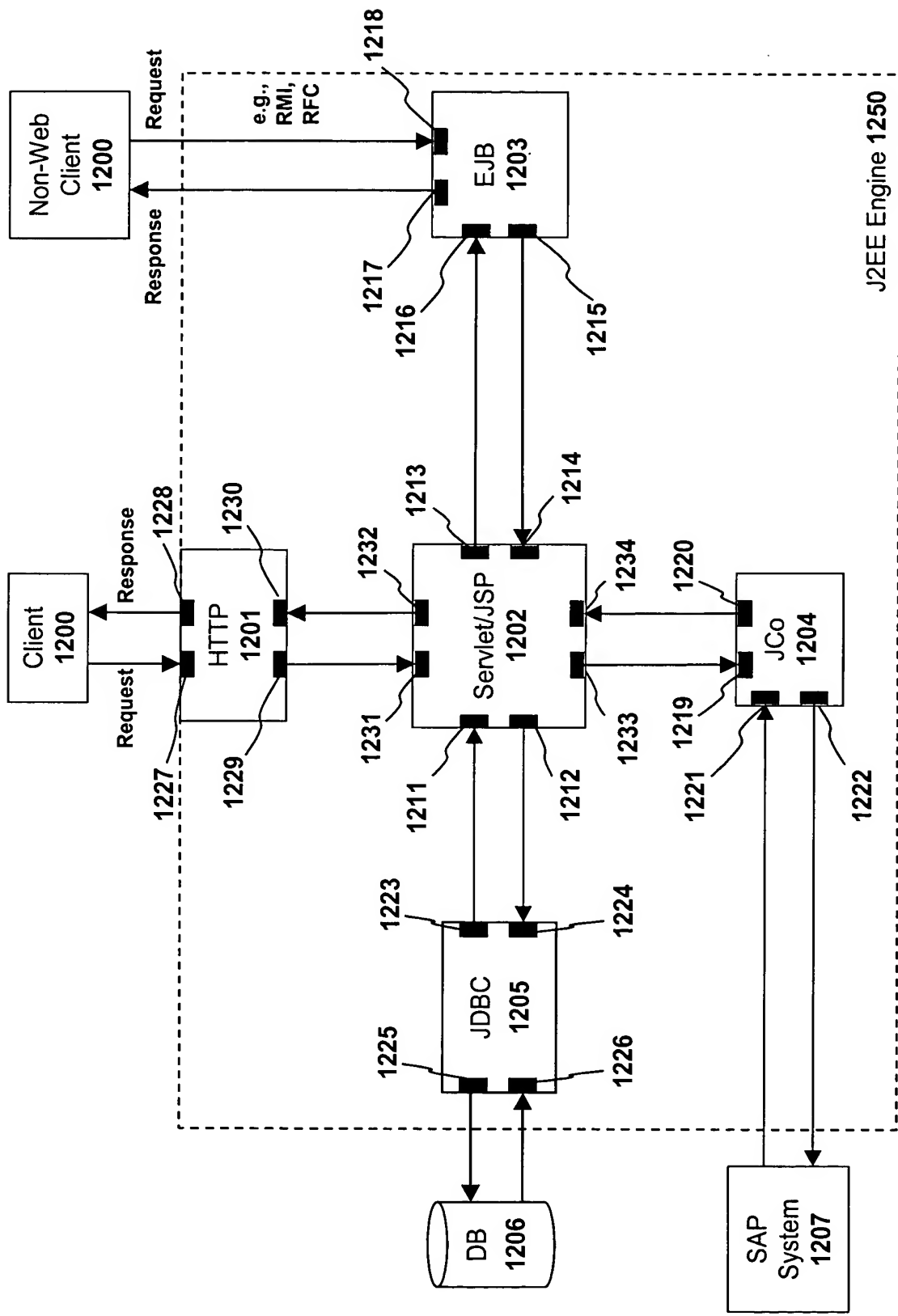


FIG. 12

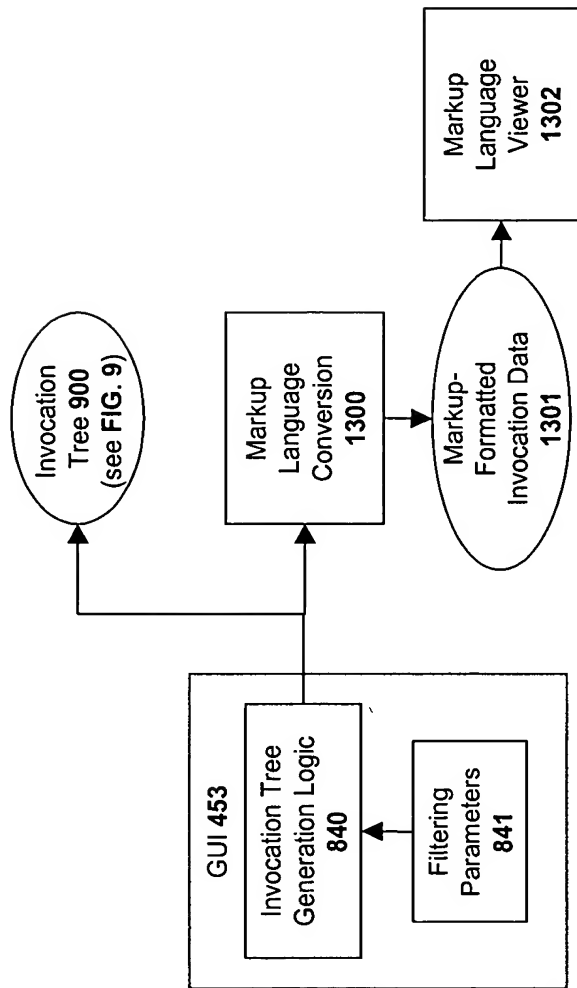


FIG. 13

FOR EACH CLASSFILE HAVING
A METHOD TO BE MODIFIED:

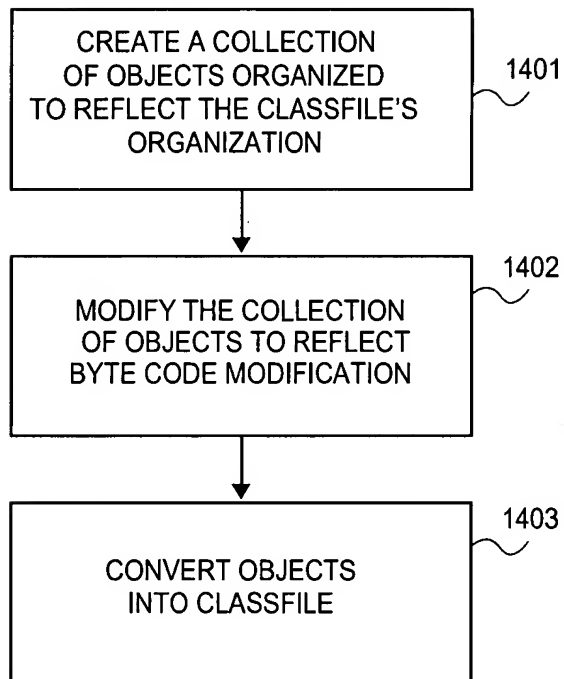


FIG. 14

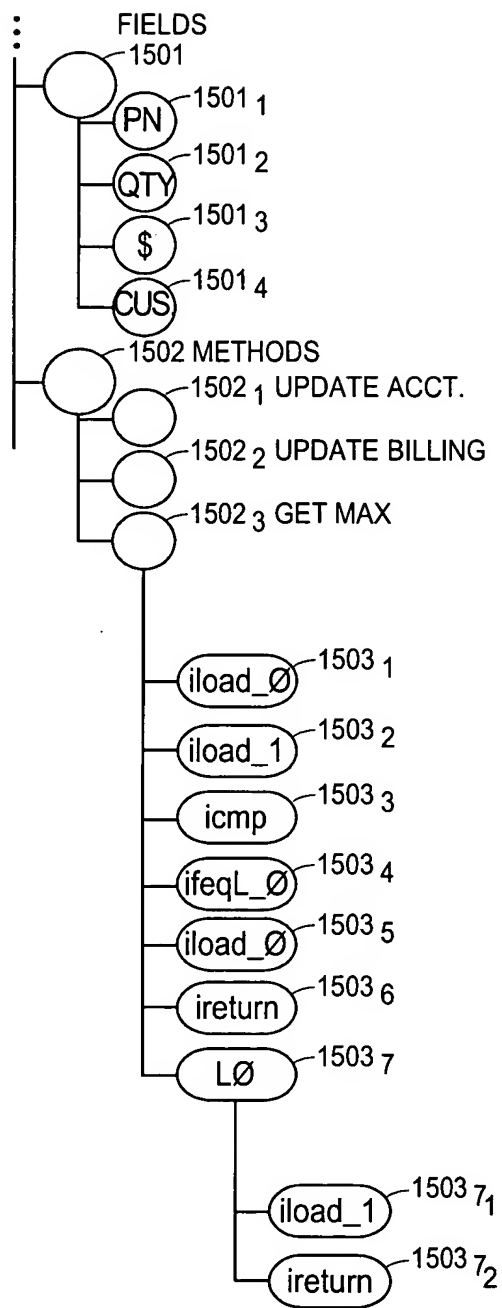


FIG. 15A

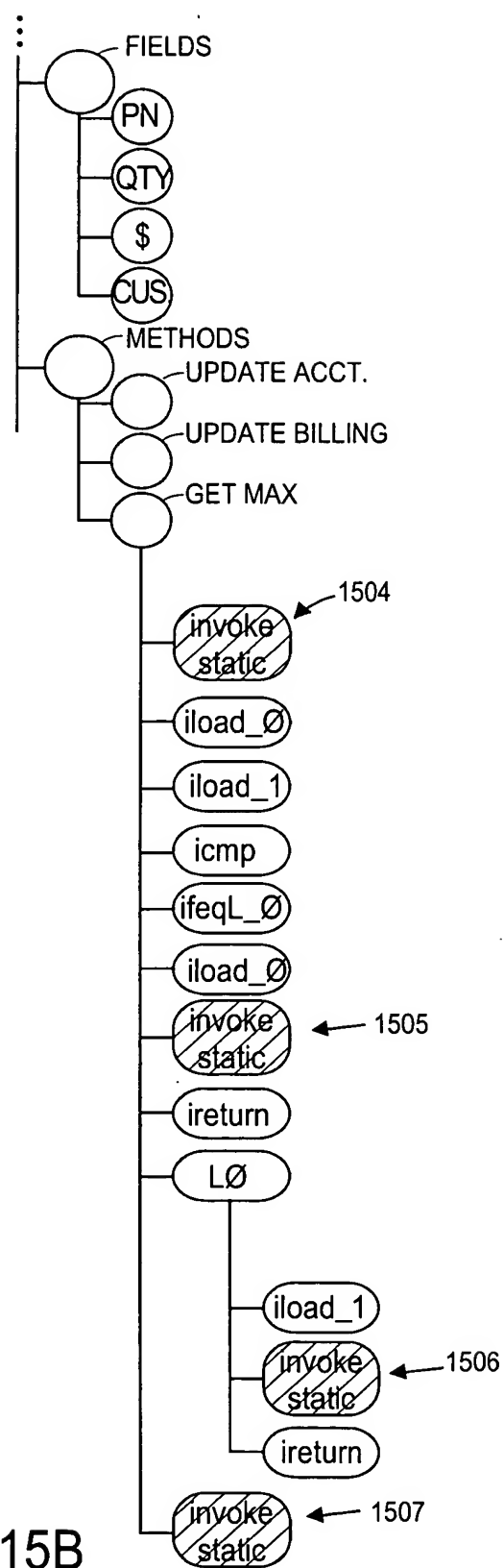


FIG. 15B

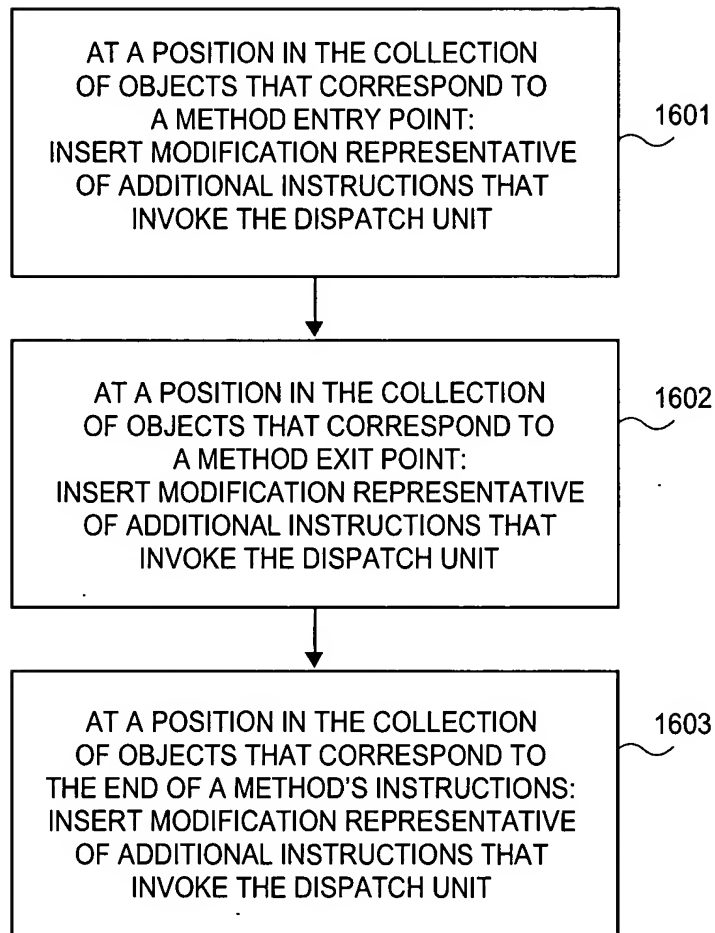


FIG. 16

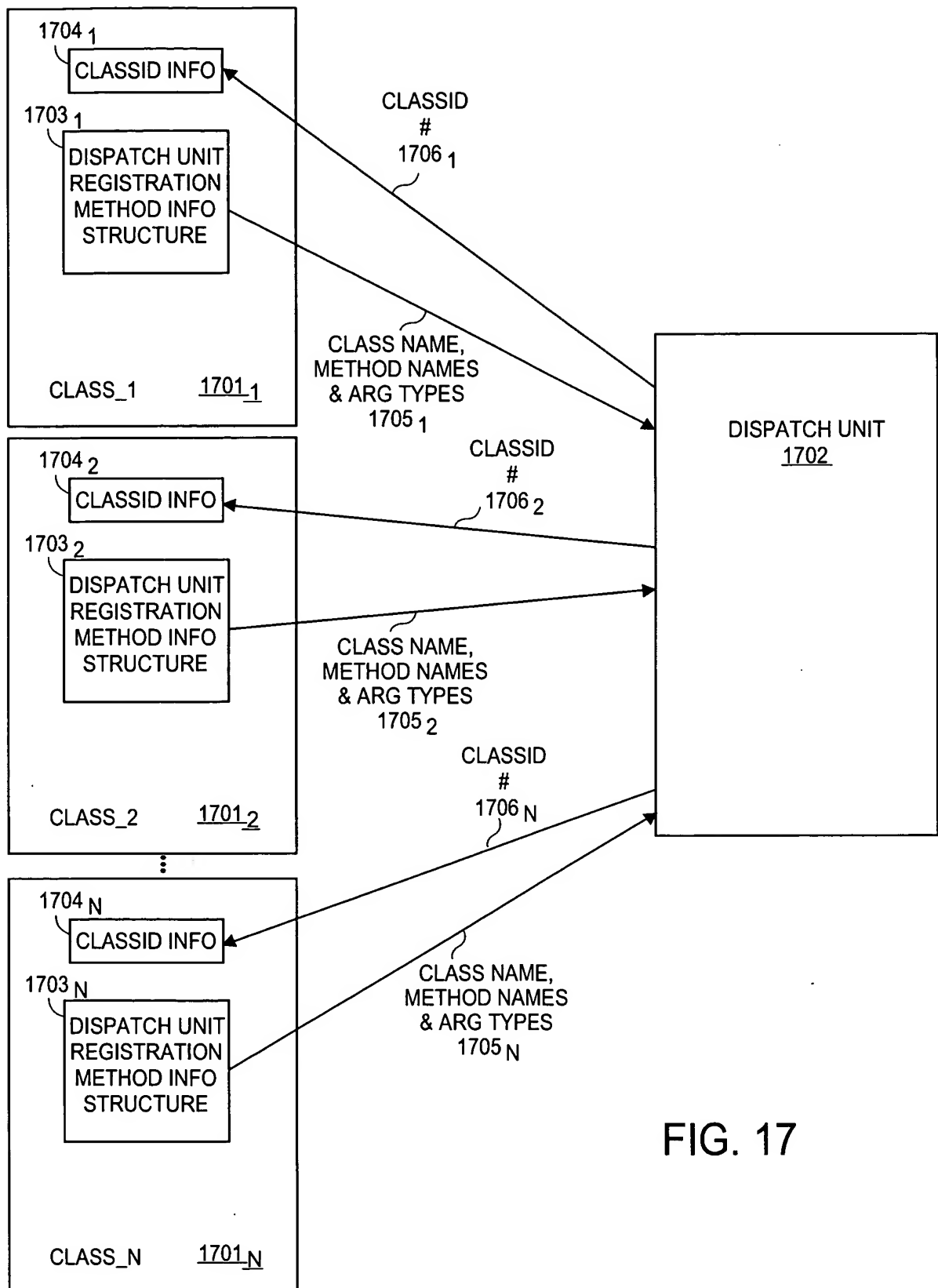


FIG. 17

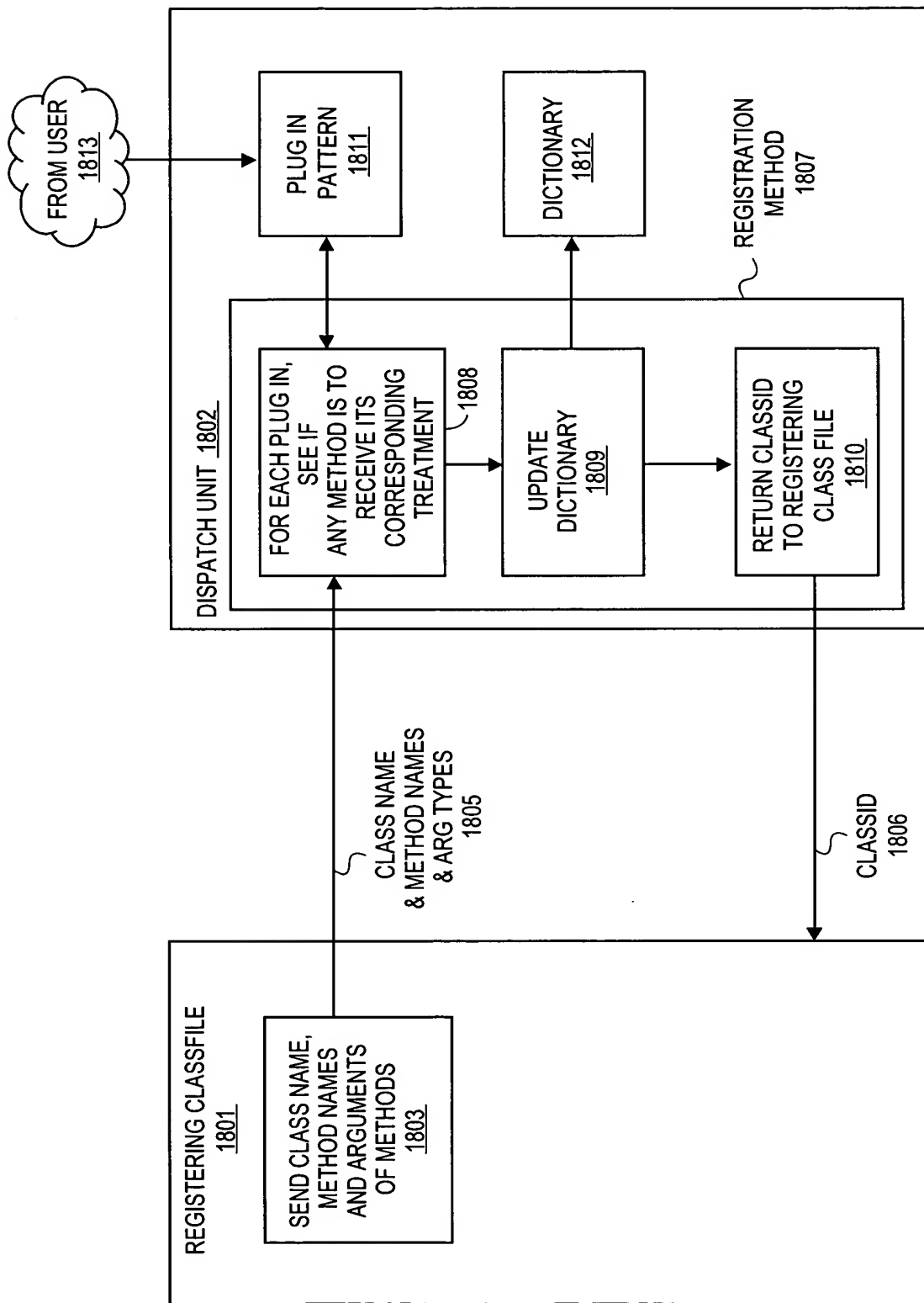


FIG. 18

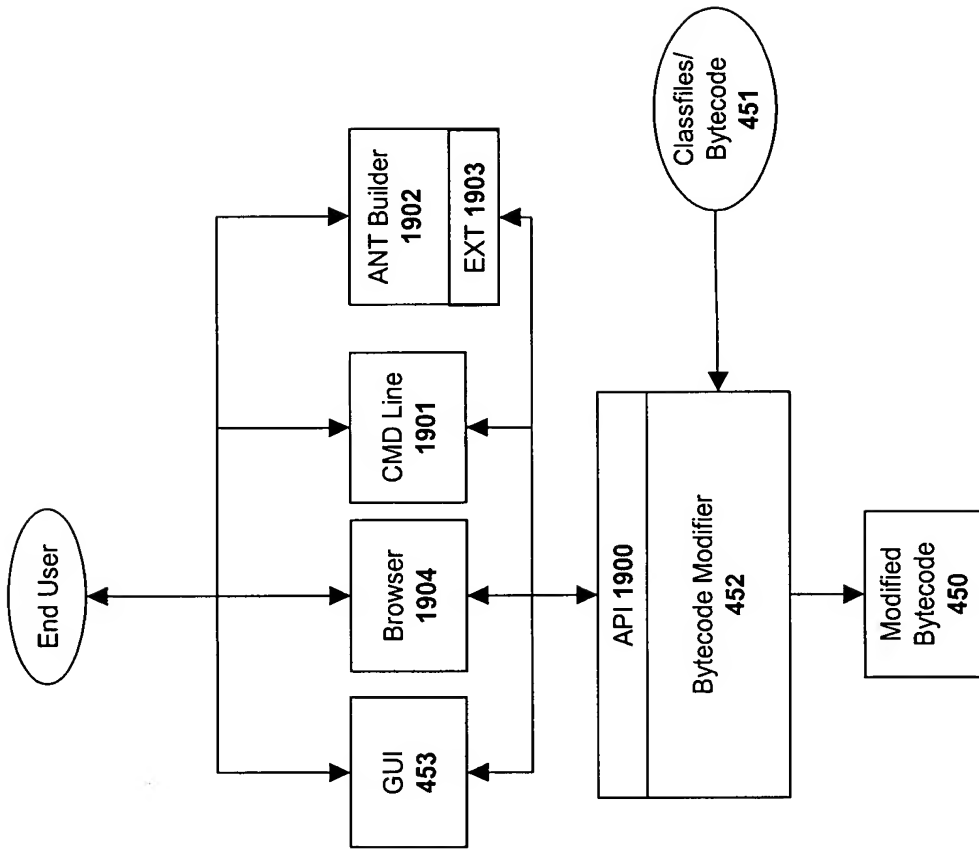


FIG. 19A

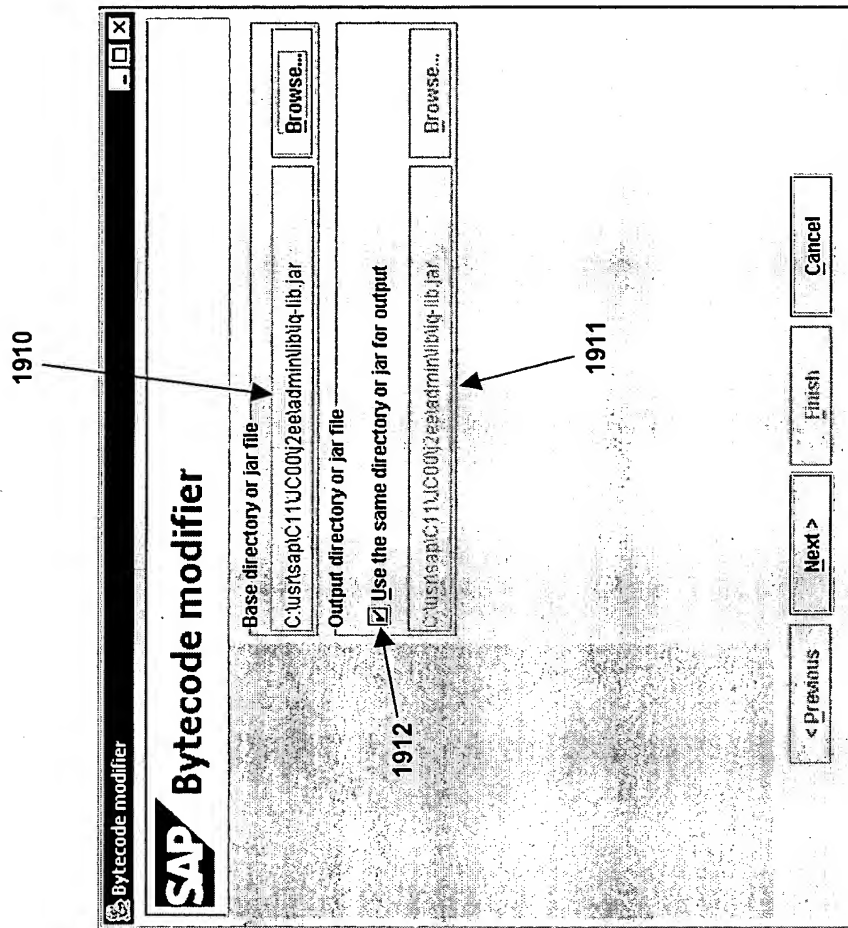
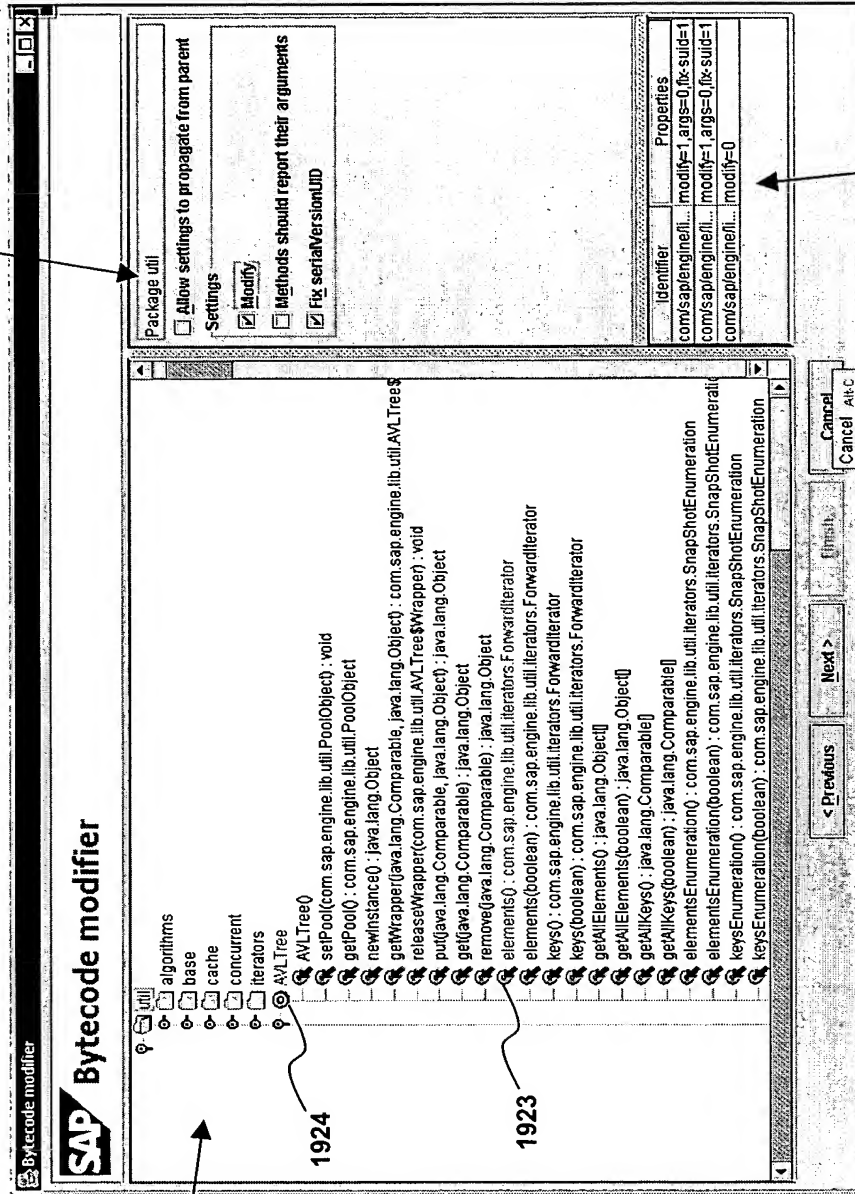


FIG. 19B

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FIG. 19C

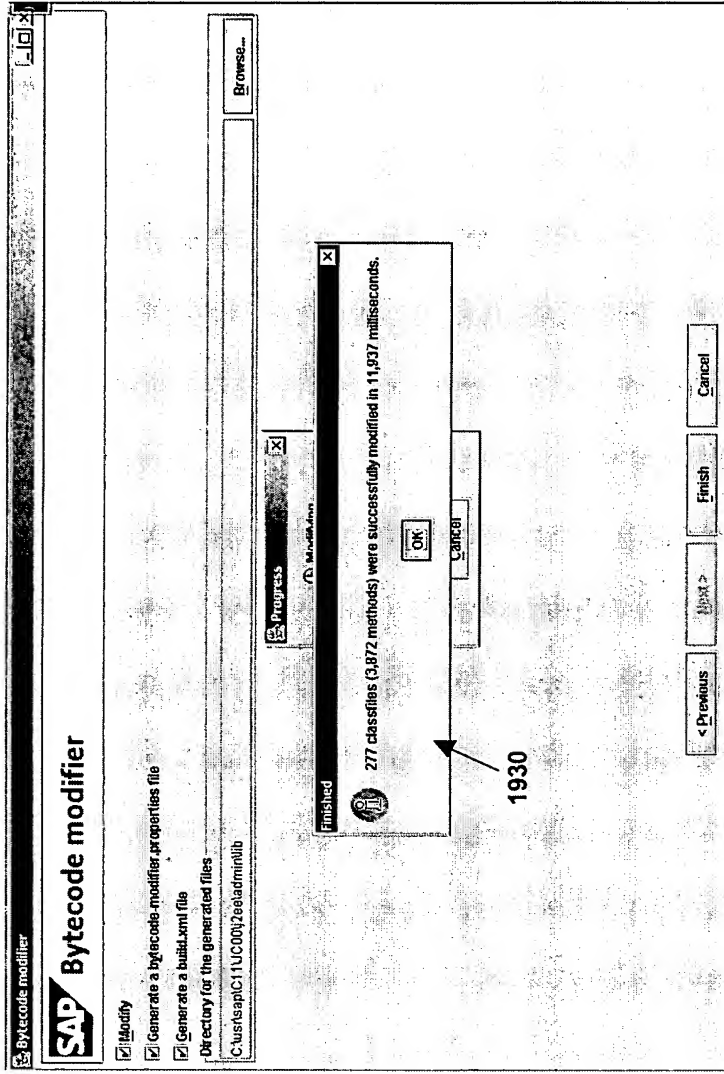
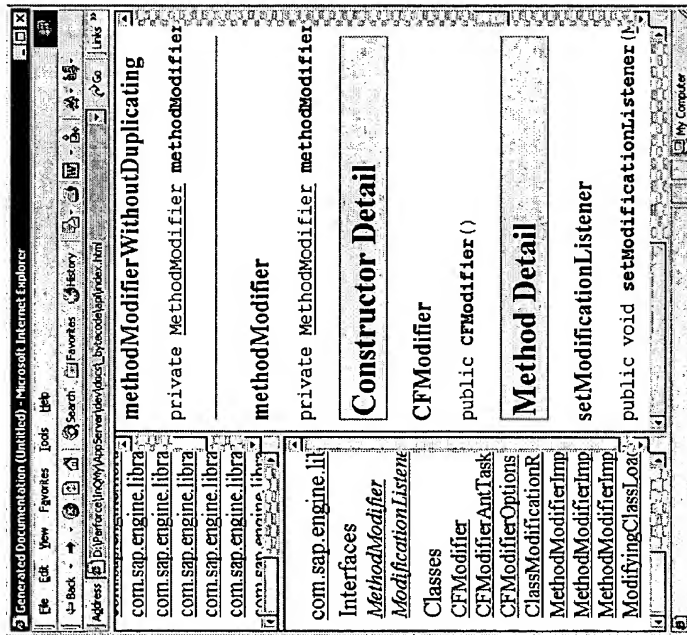


FIG. 19D



1940

FIG. 19E

```
// Direct modification of a file
CFModifier modifier = new CFModifier();
modifier.modify("D:/temp/A.class", null);

// Modification in a classloader
Class defineModifiedClass(byte[] data) {
    CFModifier modifier = new CFModifier();
    byte[] data1 = modifier.modify(data);
    return defineClass(data1);
}
```



```
>java -classpath bytecode.jar com/sap/engine/library/bytecode/
Usage:
modify <conf-file> <input-file> [<output-file>]
Runs the bytecode modifier.
    <conf-file> The configuration file for the m
    <input-file> A jar file or a directory.
    <output-file> A jar file or a directory. By de
    <input-file> and <output-file> must either be both jar
```

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FIG. 19F

ANT Builder 1902
EXT 1903



```
<taskdef name="modify"
  classname="com.sap.engine.library.bytecode.modifier.ModifierTask"
  classpath="bytecode.jar"/>
<modify conf="bytecode-modifier.properties"
  inputFile="D:\temp\classes" outputFile="D:\temp\classes1"
  check="true" verbosity="2" failonerror="true"/>
```



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FIG. 19G